

WHAT IS CLAIMED IS:

1. A negative electrode for a non-aqueous secondary battery comprising
an intermetallic compound capable of occluding/desorbing lithium as
5 an active material layer on a collector,
wherein the intermetallic compound contains at least one kind of
element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X
that does not substantially react with Li, and
in X-ray diffraction measurement with a $\text{CuK}\alpha$ -ray of the active
10 material layer, assuming that highest peak intensities of diffraction lines
derived from the intermetallic compound and the element A are I_a and I_b ,
respectively, an intensity ratio I_b/I_a is 0.1 or less.
2. A negative electrode for a non-aqueous secondary battery comprising
15 an intermetallic compound capable of occluding/desorbing lithium as
an active material layer on a collector,
wherein the intermetallic compound contains
at least one kind of element A selected from Sn, In, Ge, Ga, Pb,
Al, Sb, and Si, and an element X that does not substantially react with Li,
20 and
a protective layer for preventing a reaction between the active
material layer and the collector is provided therebetween.
3. The negative electrode for a non-aqueous secondary battery according to
25 claim 2, wherein, in X-ray diffraction measurement with a $\text{CuK}\alpha$ -ray of the
active material layer, assuming that highest peak intensities of diffraction
lines derived from the intermetallic compound and the element A are I_a and I_b ,
respectively, an intensity ratio I_b/I_a is 0.1 or less.
- 30 4. The negative electrode for a non-aqueous secondary battery according to
claim 2, wherein a main constituent element of the protective layer is
different from that of the intermetallic compound.
- 35 5. The negative electrode for a non-aqueous secondary battery according to
claim 4, wherein the main constituent element of the protective layer is at
least one kind of element selected from Ti, Ni, Zr, W, and Ag.

6. The negative electrode for a non-aqueous secondary battery according to claim 2, wherein a thickness of the protective layer is 0.05 to 0.5 μm .
- 5 7. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the element X is at least one kind of element selected from Cu, Ni, Fe, Mn, Co, Cr, Mo, W, Ti, and Zr.
- 10 8. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the element X is at least one kind of element selected from Cu, Ni, and Fe.
9. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the intermetallic compound is a NiAs type intermetallic compound belonging to a space group $P6_3/mmc$.
- 15 10. The negative electrode for a non-aqueous secondary battery according to claim 9, wherein the NiAs type intermetallic compound is Cu_6Sn_5 .
- 20 11. The negative electrode for a non-aqueous secondary battery according to claim 1 or 3, wherein, assuming that a highest peak intensity of a diffraction line derived from an intermetallic compound phase other than the intermetallic compound capable of occluding/desorbing lithium is I_c , an intensity ratio I_c/I_a is 0.05 or less.
- 25 12. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein a thickness of the active material layer is 20 μm or less.
13. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein a thickness of the active material layer is 10 μm or less.
- 30 14. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the collector is composed of at least one kind of element selected from Cu, Ni, Fe, and Ti, and an alloy thereof.
- 35 15. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the active material layer contains at least one kind of

metal element having a melting point of 700°C or lower, in addition to the element A.

16. A negative electrode for a non-aqueous secondary battery comprising an
5 active material layer substantially composed of a single phase of an
intermetallic compound capable of occluding/desorbing lithium,
the active material layer being formed by
alternately laminating, on a collector, a thin film with a
thickness of 10 μm or less containing at least one kind of element A selected
10 from Sn, In, Ge, Ga, Pb, Al, Sb, and Si and a thin film containing at least one
kind of element X selected from Cu, Ni, Fe, Mn, Co, Cr, Mo, W, Ti, and Zr,
thereby forming a laminated film, and
heat-treating the laminated film.
17. The negative electrode for a non-aqueous secondary battery according to
15 claim 16, wherein a protective layer for preventing a reaction between the
collector and the active material layer is provided therebetween.
18. The negative electrode for a non-aqueous secondary battery according to
20 claim 16, wherein the active material layer contains at least one kind of
metal element having a melting point of 700°C or lower, in addition to the
element A.
19. A non-aqueous secondary battery comprising
25 a negative electrode comprising
an intermetallic compound capable of occluding/desorbing
lithium as an active material layer on a collector,
a positive electrode, and
a non-aqueous electrolyte,
30 wherein the intermetallic compound contains at least one kind of
element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X
that does not substantially react with Li, and
in X-ray diffraction measurement with a $\text{CuK}\alpha$ -ray of the active
material layer, assuming that highest peak intensities of diffraction lines
35 derived from the intermetallic compound and the element A are I_a and I_b ,
respectively, an intensity ratio I_b/I_a is 0.1 or less.

20. A non-aqueous secondary battery comprising
a negative electrode comprising
an intermetallic compound capable of occluding/desorbing
lithium as an active material layer on a collector,
5 a positive electrode, and
a non-aqueous electrolyte,
wherein the intermetallic compound contains at least one kind of
element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X
that does not substantially react with Li, and
10 a protective layer for preventing a reaction between the active
material layer and the collector is provided therebetween.
21. The non-aqueous secondary battery according to claim 20, wherein, in
X-ray diffraction measurement with a CuK α -ray of the active material layer,
15 assuming that highest peak intensities of diffraction lines derived from the
intermetallic compound and the element A are I_a and I_b , respectively, an
intensity ratio I_b/I_a is 0.1 or less.
22. The non-aqueous secondary battery according to claim 20, wherein a
20 main constituent element of the protective layer is different from that of the
intermetallic compound.
23. The non-aqueous secondary battery according to claim 22, wherein the
main constituent element of the protective layer is at least one kind of
25 element selected from Ti, Ni, Zr, W, and Ag.
24. The non-aqueous secondary battery according to claim 20, wherein a
thickness of the protective layer is 0.05 to 0.5 μm .
- 30 25. The non-aqueous secondary battery according to claim 19 or 20, wherein
the element X is at least one kind of element selected from Cu, Ni, Fe, Mn, Co,
Cr, Mo, W, Ti, and Zr.
26. The non-aqueous secondary battery according to claim 19 or 20, wherein
35 the element X is at least one kind of element selected from Cu, Ni, and Fe.
27. The non-aqueous secondary battery according to claim 19 or 20, wherein

the intermetallic compound is a NiAs type intermetallic compound belonging to a space group $P6_3/mmc$.

28. The non-aqueous secondary battery according to claim 27, wherein the
5 NiAs type intermetallic compound is Cu_6Sn_5 .

29. The non-aqueous secondary battery according to claim 19 or 21, wherein,
assuming that a highest peak intensity of a diffraction line derived from an
intermetallic compound phase other than the intermetallic compound capable
10 of occluding/desorbing lithium is I_c , an intensity ratio I_c/I_a is 0.05 or less.

30. The non-aqueous secondary battery according to claim 19 or 20, wherein
a thickness of the active material layer is 20 μm or less.

15 31. The non-aqueous secondary battery according to claim 19 or 20, wherein
a thickness of the active material layer is 10 μm or less.

32. The non-aqueous secondary battery according to claim 19 or 20, wherein
the collector is composed of at least one kind of element selected from Cu, Ni,
20 Fe, and Ti, and an alloy thereof.